

NASA TECH BRIEF

Marshall Space Flight Center



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Automated Shell Theory For Rotating Structures (ASTROS)

The problem:

Several programs are available for determining the stresses and deformations of rotating structures, but these have been limited to disks and are based on the finite difference method. In using the finite difference method, the user must divide the structure into very small segments and determine values for each segment. In the analysis of almost all geometric shapes, the input values must be approximated, especially for a variable-thickness structure. The results can be made more accurate only by dividing the structure into more and smaller segments for closer approximations.

The solution:

A computer program, **ASTROS**, has been developed to handle larger segments of the structure in the computer model to minimize the amount of input to the program. It has a larger program capability and gives accurate results.

How it's done:

The **ASTROS** computer program can be used to analyze any disk or shell of revolution of arbitrary cross section under inertial loads caused by rotation about the shell axis and under various static loads, including thermal gradients. The geometric shapes incorporated in the program are ellipsoidal, spherical, ogival, toroidal, conical, circular plate, cylindrical, and parabolic.

Four classifications of information are used as program input:

- (1) Geometry Data — the geometric description of each segment of the disk or shell revolution.

- (2) Material Data — thickness and material properties of the segment.
- (3) Topology Data — the manner in which all the segments are interconnected to form a structure.
- (4) Load Data — temperature and loading data, both concentrated and distributed, and angular velocity.

Many features of this program such as treatment of the branched shells, stiffened wall construction, and thermal gradients are retained from a computer program named **STARS II** (Shell Theory Automated for Rotational Structures II) which was developed by the Grumman Aircraft Engineering Corporation. The **STARS** program is not available from **COSMIC**.

Notes:

1. This program is written in **FORTRAN IV** to be utilized on the **UNIVAC-1108** computer. It has also been used successfully on the **IBM-7094** computer.
2. The program is disseminated only in card form.
3. Inquiries concerning this program should be directed to:

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